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## Concept of the green spaces system – Belgrade case study

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### Introduction

Contemporary approach to urban development, founded on sustainable development principles, is counting on urban green spaces system as one of the most significant city infrastructure. The term implies integration of multifunctional open spaces – various types of green spaces, water courses and open rural areas, distributed in such a way to contribute to improvement of life and working conditions in the city, to protection of biodiversities of urban sites and to the attractiveness of city vista (Teofilović, Cvejić, et al.; 2009).

The city of Belgrade is the capital of the Republic of Serbia, situated in South-East Europe in Balkan peninsula. According to the population census from 2002, the population of the inner city territory was 1.326.872. The City is situated at the confluence of the two big rivers, Sava and Danube. The surroundings of Belgrade consists of the two different natural entities: Pannonia lowlands in the North and Šumadija upland in the South. The expressed relief plasticity of Belgrade in the South of the Sava and Danube, conditioned the spreading of the City across hilly terrain. In the North of the Sava and Danube are alluvial plains and loess plateau, separated by a steep loess section, to 30 meters high. Due to the position of Belgrade in the contact zone of the two highly contrasted natural entities, a great variety of vegetative biocenosis of flora and fauna exists.

Urban planning in Belgrade have had a long and rich tradition since 1842, when the first plan of the City was adopted. The development of the green spaces system of Belgrade went on side by side with the urban planning of the City. The basic concept of establishment of the green spaces system, by connection of the city center and its housing areas via alleys and corridors of greenery with the City surroundings, has not been substantially modified in the up-to-date urban plans. Nevertheless, that idealistic vision of the integral system of the City green spaces, present in plans, has not been realized up till now. On the contrary, occupations and irregular changes of land use for the spaces marked in plans for greenery are more and more often present. From the point of view which is based on the interests of investors, green spaces of Belgrade are primarily an unbuilt land, meaning potentially available and variously attractive and profitable land resource. This is especially prevailing under condition of a weak control of constructions, inadequate legal regulations and flexible interpretation of the existent plans, enabling multiple manipulations in distribution of construction sites (Djukanović, 1994).

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On the other hand, the strategic choice that Belgrade should be planned on sustainability principles, asks for a different relation towards the green spaces system of the City. That was the reason why the Secretariat for Environmental Protection of Belgrade initiated elaboration of the project „Green Regulations of Belgrade“ (Teofilović, Cvejić, et al.; 2003). Three stages of the project has been completed up till now, and its ultimate goal is, besides determining of an adequate legal regulations, design of a special urban plan of the green spaces system of Belgrade (coming stage four). As significant stages of the project „Green regulations of Belgrade“, from the standpoint of the final goal, might be highlighted: Mapping and Evaluation of biotopes of Belgrade (Teofilović, Cvejić, et al.; 2007) and design of the „Program for elaboration of the urban plan of the green spaces system of Belgrade“ (Teofilović, Cvejić, et al.; 2009).

This work is aiming to present the new concept of the green spaces system of Belgrade defined in mentioned projects and based on the detailed and multiannual analysis, estimations and research, as well as on GIS, biotopes of Belgrade data.

### **Background/Literature Review**

The planning of the urban areas is of great significance for the majority of human population. Housing, commercial, working and recreational surroundings is the result of some level of planning in this type of surroundings. The planning of cityscapes of Belgrade was mostly physical planning, based on satisfaction of needs. It is known today that such an approach contributed to the majority of negative changes and consequences following the development and growth of cities in the world. Some of them are: changes of natural ecosystems and irrevocable loss of natural resources, domination of artificial and biologically sterile facilities and scheme change of spatial structures. The consequences are: establishing of "urban heat islands", increasing level of air and water pollution, perturbation of water and energy balance and undesirable effects of conflict neighborhoods (Beer,1993). The other landscape - ecological approach in planning of cityscapes, advocated by many authors (Fabos,1985; Beer,1993; Ermer,1996; Sukopp,1998; Fabos, 2004; Gordon, 2009) had a little influence in planning of Belgrade in the past. As the first bigger shift towards landscape-ecological planning of the City is elaboration of biotopes GIS and evaluation of Belgrade's biotopes. The results of mapping and evaluation have shown that in the City territory there existed a great diversity of biotopes, (52 types and 181 of subtypes were separated in the area of 77.460 hectares, within total of 163.800 geometrically separated biotopes) as well as diversity of species, (161 species of ornithofauna included in the national red list were registered, 9 relicts and 16 species of flora from the national red list, etc.). Some valuable biotopes of forest, wetland and line corridors significant for netting of the future system were also registered. The project of mapping and evaluation of the biotopes of Belgrade was a significant baseline for multifunctional approach to planning of the new concept of the City green spaces system.

Besides mentioned project, a significant source of information are informal plans and studies, among them are: Integral valorization of forestry resources of Belgrade (Institute of Forestry, 2005), Characterization of the types of landscapes in Belgrade study (Faculty of forestry, 2008), Plan for proclamation of the erosive areas for the inner territory of the City (Institute for the development of water resources Jaroslav Černi, 2005), Study of riversides area of Belgrade (Town planning institute of Belgrade, 2007).

Further research was directed towards analysis and estimation of the present state of green spaces from various angles. As an instructive case study, patterned out for the approach and methodology of the analysis and estimation of green spaces, „Hackney open space study, Volume 1.“ (Atkins, 2004) was used. Hackney study includes qualitative and quantitative review and analysis of supply of and demands for open spaces and sports facilities in London Borough of Hackney, England.

### **Goals and objectives**

Present situation of incoherence and discontinuity of the green spaces of Belgrade and the increasing problem of the urban environmental load, as well as occupation of green spaces with the other land uses, put-upon the need for research and analysis of the existent state and potentials for introduction of the new concept of the City green spaces system. The following goals were set up:

- Concept of green spaces should be founded on detailed analysis of the existent state and data from preceding studies, with appreciation of continuity in general assumptions of the green spaces system, planned in up-to-date urban master plans;
- Harmonization of typology of Belgrade's green spaces with typologies of European cities in order to apply European standards, conventions, directives, etc.;
- Preservation of the existent green spaces within the existent limits;
- Protection of the highly evaluated biotopes, based on the project of mapping and evaluation of biotopes (Teofilović, Cvejić, et al., 2007);
- Planning of new green spaces in the areas estimated as deficient in green spaces, of passive and active recreation, as well as in the areas of the registered break in spatial continuity of the system;
- Establishing the network of green corridors as linking elements of the system.

### **Methods**

Planning method of the new concept of Belgrade's green spaces included several working steps. Those steps were applied as follows:

- Step 1: Analysis of the green spaces system in master plans realized in the period from 1951 to 2009;
- Step 2: Creation of the new green spaces typology;

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- Step 3: Analysis of presence and spatial distribution of green spaces in the territories of the city municipalities with cumulative presence assessment;
- Step 4: Accessibility analysis of the existent green spaces in function of the active and passive recreation with indication of deficient areas;
- Step 5: Provision of green spaces for residents in relation to: environmental quality; active and passive recreation in local and municipality level;
- Step 6: Quality of green spaces assessment by applying criteria Civic Green Flag Standard (Atkins,2004);
- Step 7: Value of green spaces assessment from the standpoint of their multifunctionality, by applying criteria according to Atkins (2004).
- Step 8: Assessment of local needs for green spaces, by applying criteria according to Atkins (2004);
- Step 9: Based on the results of the conducted analysis, conceptualization of the basic preferences in determining concept of the green spaces system;
- Step 10: Determining concept of the green spaces system.

## Results

The analysis of the system development in up-to-date urban master plans has shown that the general concept of the system defined by the plan from 1951, hasn't been significantly changed in the later plans. The system consisted of forest semi ring around the City and greenery penetration in the City core in the form of pins, line and band green corridors, accentuating riversides area as the most significant green corridor in the City.

The next important step in elaborating concept of the system was the improvement of the green spaces typology, primarily by including of the group of naturally regulated green spaces, besides the group of maintained green spaces (Teofilović, Cvejić, et al., 2007) (Table 1):

**Table 1. Typology of Belgrade's green spaces**

MAINTENANCE OF GREEN SPACE	
a)Free standing	Park; Square; Botanical garden; Zoo; Cemetery; Park forest Garden colonies, River islands, Forests
b) With linking function	In transport route regulation; in aquatic land
c) Besides structures	Various type of housing tissue; industrial, commercial, infrastructural facilities; Sports facilities; Public use facilities
NATURAL REGULATION OF GREEN SPACE	
a)Free standing	Plantation; Habitats similar to forest; Fallow land; Wetlands
b)With linking function	Shrubbery and the rest of the forest in aquatic land – foreland; Shrubbery and the rest of the forest in agricultural land

In the City territory, 9333 hectares of maintained and 5922 hectares of naturally regulated green spaces were registered. The most represented modality of green spaces is forest, 40%, then forest and shrubberies in agricultural land, 20%. The

distribution analysis of green spaces has shown that 60% of the total green spaces is situated in three city municipalities, pointing out their uneven distribution within the City.

The total of 109 green spaces of various types was isolated, with possibilities for active and passive recreation of population. Accessibility to isolated green spaces to be used for recreation was analyzed in three different levels: local (distance from home 400 meters airline); city (distance from home 1200 meters airline); and regional (distance from home 3200 meters airline). Overlapping the maps with services zones for residents, elaborated in GIS, resulted in the map of the deficient areas in function of everyday recreation, the significant baseline for the future concept of green spaces system.

The estimation concerning supply of green spaces for residents was conducted from the following angles: environmental quality (standard 225 m<sup>2</sup>/per capita) (Coder, 1996); active and passive recreation in municipality level (standard 13 m<sup>2</sup>/per capita) (Miess, 1987); active and passive recreation in local level (standard 6 m<sup>2</sup>/per capita) (Miess, 1987). Analysis in city municipalities has shown that only one municipality was above the standard of 225m<sup>2</sup>/per capita, while five municipalities were above the standard of 13 m<sup>2</sup>/per capita and seven municipalities had a bigger share of green spaces per capita than the standard of 6 m<sup>2</sup>/per capita.

Founded on the analysis of green spaces quality, it was concluded that green spaces present in Belgrade are of the average and under-average quality (criteria: accessibility, safety, maintenance quality, preservation of natural and cultural heritage), while in relation to value, the green spaces of the average and small value and worthless were determined (criteria: access to site, cultural heritage, ecological value, environmental value, educational part, cultural function).

In relation to available data, the need for green spaces of the local residents was analyzed according to criteria: population age, population density; housing type; population density in the age group from 0 to 14; population health conditions. Resulting data directed conceptual plan solution in a way that new green spaces were primarily distributed in the areas where the biggest needs for them were expressed.

Concept of green spaces system of Belgrade was determined in respect of the following principles: connectivity, multifunctionality, accessibility, protection of landscape character, biodiversity protection, environmental upgrading. Spatial realization of conceptual preferences was planned by establishing the system of mutually linked green spaces. Constitutive elements of the system are dominants, spots and lines. Dominants are large green spaces, perceptible in space, having significance for the City, or even regional significance; they are fundamental elements of the greenery system. Spots are smaller green spaces of local significance, while the lines represent types of green spaces with linking function. Accepting ensuing results, characteristic city areas as the basic components of the system are isolated (Figure 1):

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**Figure 1. The basic components of the system of green spaces in Belgrade**

System „Core“ is dominant of the integral solution, including the confluence of the Sava and Danube. Upgrading of multifunctionality of the existent green spaces, as well as establishing of a new recreational City zone were both planned.

„Inner ring“ of the system consists mainly of the middle city zone with green spaces in minimal mutual distance of 400 meters. The dominants are existent parks, forests and park forest, as well as green spaces of the open housing city blocks. New green spaces are planned in fallow lands areas, mostly within, or in close vicinity of the areas marked as deficient of green spaces, as well as in the parts of the ring where discontinuance in the system of green spaces was found out.

„Outer ring“ of the system includes peripheral zones of the City. The dominants are forests, naturally regulated green spaces, mostly in agricultural spaces. Significant role as the line elements, belongs to shrubberies and hedge-rows in agricultural land. New green spaces are planned aiming to achieve the suggested standard for improving living conditions of 225 m<sup>2</sup>/per capita, as well as of the standard 6 m<sup>2</sup>/per capita within or in close vicinity of the areas marked as deficient of green spaces for recreation.

„Green links“ of the system is the city territory within aquatic land of the Sava and Danube rivers and along small city watercourses and along principal arterial transport routes. Basic function of this system component is linking of the other system components.

„Continually constructed city tissue“ consists of the territories in the central and middle city zone. The establishment of the system is planned by free standing green spaces in the form of spots, and by tree lines as connective elements.

„Discontinually built area“ is the territory of outer and peripheral zones of the city. In the territory where agricultural structures and suburban settlements are dominant, system establishment is planned by green spaces in the line forms, like forests remains, shrubberies and hedge-rows in agricultural land and along small city watercourses and melioration canals.

### **Discussion and conclusion**

The new concept for the system of green spaces of Belgrade, as a difference towards the old solutions, accentuated significance of the green spaces in the confluence and riversides area of the two big rivers, Sava and Danube, by distinguishing of the system “core” and tracing of the strong “green links” along the riversides area. The other significant component of the system are green corridors along the traffic network. Two rings, inner and outer, are connected upon this basic “skeleton” of the system, mutually linked by the numerous green corridors along the small city watercourses and network of melioration canals in alluvial plain of Belgrade area.

The important novelty in relation to the up-to-date planning of the City of Belgrade is the improvement of green spaces typology, including the total of the maintained, though of the naturally regulated green spaces, too. The study of mapping and evaluating of the city biotopes, implemented for the first time in Serbia in the City territory, enabled, besides protection of the remaining valuable biotopes, also very detailed information about available resources for the development of new green spaces. New cognitions derived from the study are first of all related to the great variety of biotopes and species, surviving in urban area such as Belgrade.

The new concept of the green spaces system of Belgrade, founded on landscape-ecological approach, detailed analysis of the present state, application of European standards and modern planning theories, came close to practices of system planning in other European cities. The applied planning method, although modified and adjusted to available data and given detailedness of elaboration, is not a novelty from the point of view of the European practice, still its application in Belgrade case is its recheck and a new experience, the example of the applied case study.

Contribution of the applied method could be seen in the national level as well. It is beyond doubt a new approach including understanding of the significance of the greenery system of a city. As a unique contribution, the thorough argumentation prepared by the all conducted studies and analysis could be emphasized, the works that might have an important role in achieving consensus about the future urban planning of the City. The other significant contribution is the shift in philosophy and approach to the planning of the City, based on the landscape-ecological knowledge. The new concept is an example of appreciation concerning multifunctional role of



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the City green spaces. From the Belgrade's point of view, significant contribution is by all means reservation of space, excluded from future constructions, due to their specific role and provision of the integral system of the city green spaces.

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